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2022-mm-dd

**Natural stone products — Slabs for
cladding — Requirements**

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Requests for permission to reproduce this document should be addressed to:

Rwanda Standards Board

P.O Box 7099 Kigali-Rwanda

KK 15 Rd, 49

Tel. +250 788303492

Toll Free: 3250

E-mail: info@rsb.gov.rw

Website: www.rsb.gov.rw

ePortal: www.portal.rsb.gov.rw

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 519 was prepared by Technical Committee RSB/TC 9, *Civil Engineering and Building Materials*.

In the preparation of this standard, reference was made to the following standard (s):

EN 1469: Natural Stone Products. Slabs for Cladding. Requirements

The assistance derived from the above source is hereby acknowledged with thanks.

Committee membership

The following organizations were represented on the Technical Committee on *Civil Engineering and Building Materials* (RSB/TC 9) in the preparation of this standard.

Enabel Rwanda

University of Rwanda — College of Science and Technology (UR — CST)

Integrated Polytechnic Regional Centre (IPRC) — Musanze

Rwanda Housing Authority

Road Transport Development Agency (RTDA)

Rwanda Inspectorate, Competition and Consumer Protection Authority (RICA)

Mass Design Group

Rwanda Quarries Association (RQA)

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Stonecraft Industries Ltd

Greenpack Africa Ltd

NP Construction Company (NPCC) Ltd

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Natural stone products — Slabs for cladding — Requirements

1 Scope

This Standard specifies requirements for slabs of natural stone that are made for use as cladding for internal and external wall and ceiling finishes.

This Standard does not cover aggregates and artificially agglomerated stone material and does not cover installation. Furthermore, this Standard does not cover roofing slates used as external cladding and slates and stone products for discontinuous roofing. This Standard does not consider fixing by means of mortar and adhesives.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

DRS 548, Masonry and masonry products — Methods for determining thermal properties

DRS 525, Natural stone test methods — Determination of water absorption coefficient by capillarity

DRS 526, Natural stone test methods — Determination of real density and apparent density, and of total and open porosity

DRS 533, Natural stone test methods — Determination of flexural strength under concentrated load

DRS 527, Natural stone test methods — Petrographic examination

DRS 528, Natural stone — Denomination criteria

DRS 515, Natural stone — Terminology

DRS 529, Natural stone test methods — Determination of the breaking load at dowel hole

DRS 530, Natural stone test methods — Determination of geometric characteristics on units

DRS 541, Natural stone test methods - Determination of resistance to ageing by thermal shock

DRS 547, Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire tests

DRS 549, Natural stone test methods — Determination of water absorption at atmospheric pressure

DRS 531, Natural stone test methods — Determination of resistance of marble to thermal and moisture cycles

ISO 10456, Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values

ISO 12572, Hygrothermal performance of building materials and products — Determination of water vapour transmission properties

3 Terms and definitions

For the purposes of this document, the terms and definitions given in DRS 515 and the following apply.

3.1

slab for cladding

slab cut to size to be used as cladding for internal and external walls and may be fixed or suspended at any angle

3.2

dimensions of slabs for cladding

length l , width b and thickness d are the dimensions of a slab for cladding for external and internal use

Note 1 to entry: Dimensions are given in the stated sequence in millimetres (see Figure 1).

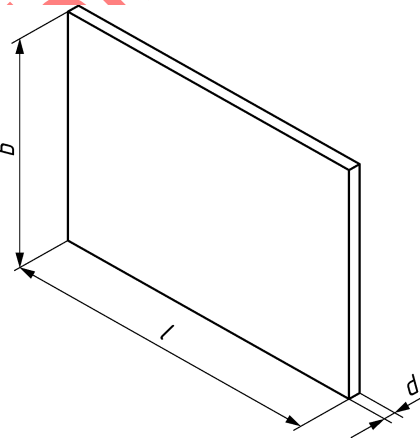


Figure 1 — Dimensions of a slab for cladding

3.3

lower expected value

lower expected value (E_L) corresponds to the 5 %-quantile of a logarithmic normal distribution for a confidence level of 75 %

3.4

higher expected value

higher expected value (E_H) corresponds to the 95 %-quantile of a logarithmic normal distribution for a confidence level of 75 %

4 Characteristics of natural stone for cladding

4.1 Geometrical characteristics

4.1.1 General

All measurements shall be carried out in accordance with DRS 530 and all measured values of individual units shall fall within the required tolerances.

4.1.2 Thickness

The thickness shall be measured in accordance with DRS 530 and the measured values shall not deviate from the nominal thickness by more than given in Table 1

Table 1 — Tolerances on the nominal thickness

Nominal thickness in mm	Tolerance
More than 12 Up to and including 30	±10 %
More than 30 Up to and including 80	±3 mm
More than 80	±5 mm

Stricter deviations may be declared by the manufacturer. This is particularly important when the edges of the slabs will be visible after installation.

NOTE If the slab is to be fixed by adhesive or a thin mortar bed, stricter tolerances may be needed.

The required thickness of slabs shall result from a structural analysis or similar procedure that takes into account the technical and physical properties of the stone and the intended application.

For natural cleft/riven faces, Table 1 does not apply and the deviations on thickness shall be set out by the manufacturer.

4.1.3 Flatness

The deviation from flatness of the surface (except for natural cleft faces) when measured in accordance with DRS 530 shall not exceed 0,2 % of the slab length, and shall not exceed 3 mm. For natural cleft faces, the tolerance on flatness shall be declared by manufacturer.

4.1.4 Length, width and squareness

The length, width or squareness shall not deviate from the nominal size by more than the tolerances given in

Table 2. Measurements shall be made according to DRS 530.

Table 2 — Tolerances on length, width and squareness

Nominal length or width in mm	< 600	≥ 600
Sawn edges thickness ≤ 50 mm	±1 mm	±1,5 mm
Sawn edges thickness > 50 mm	±2 mm	±3 mm
Squareness	±1 mm	±2 mm

Stricter deviations may be declared by the manufacturer.

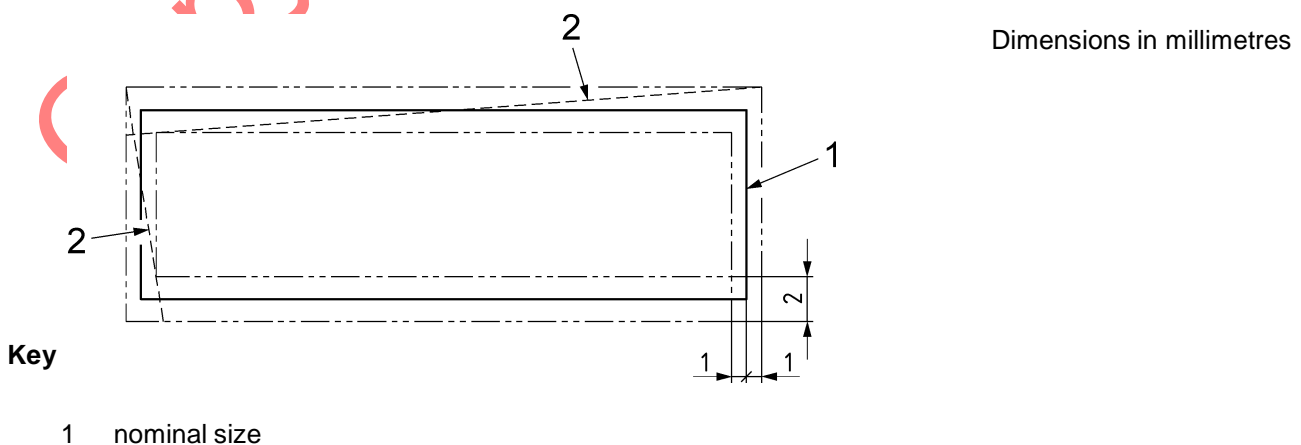
For natural cleft/riven edges, Table 2 does not apply and the tolerances on length, width and squareness shall be set out by the manufacturer.

4.1.5 Special shapes

The permissible deviation at any point shall be as stated in Table 2 (see Figure 2).

Each slab angle shall be in accordance with the agreed geometry. Pieces of special or irregular shape shall be checked for compliance with the required shape by use of a suitable template, the permissible deviation at any point shall be as stated in Table 2.

Stricter deviations may be declared by the manufacturer. This is particularly important when the edges of the slabs will be visible.



- 2 the slab sides shall fall within the two dotted lines indicating the tolerances of length and width according to Table 2

Figure 2 — Example of tolerances on angles

4.1.6 Location of dowel holes

The specified location, depth and diameter (shape) of dowel holes shall be as follows:

- a) Location measured along the length or width of the slab: ± 2 mm
- b) Location measured along thickness: ± 1 mm (to be measured from the exposed face)
- c) Depth: $+ 3 / - 1$ mm
- d) Diameter: $+ 1 / - 0,5$ mm

Stricter deviations may be declared by the manufacturer.

For other fixing systems (e.g. slots), specific deviations shall be declared by the manufacturer.

4.1.7 Commercial sizes of slabs for cladding

Commercial sizes shall be based on the area of the smallest possible circumscribed rectangle measured in square metres accurate to two decimal places.

NOTE For small units it may be necessary to agree a minimum size, for example $0,25 \text{ m}^2$.

4.1.8 Surface finish

4.1.8.1 General

Surface finishes shall be carried out uniformly to the edges of the cladding slab

The surface treatment of some types of stones may typically involve the use of patching, fillers or other similar products for natural holes, faults or cracks; this is to be considered as part of the normal processing. In such cases the type of treatment, as well as the type and nature of additional materials, shall be declared.

4.1.8.2 Surfaces after surface finishing

Surfaces shall have a regular appearance as a function of the finishing process and shall be worked to meet the specified finish (e.g. making reference to samples, see 4.2.3) on all exposed surfaces. For definitions of surface finishes see WD 1.

4.2 Physical and mechanical characteristics

4.2.1 General

When during production the products have been subjected to a treatment that alters the properties of the stone (e.g. chemical or physical treatment, patching or filling or other similar products for natural holes, faults or cracks) then the use of such treatment shall be stated and changes to the physical and chemical properties considered.

In addition, specimens for testing shall be representative of the product and any process(es) that the stone is subjected to.

The following characteristics shall be declared where requested by this standard or with reference to the intended use conditions.

4.2.2 Denomination

The denomination shall always be declared in accordance with DRS 528 (it means traditional name, petrological family, typical colour and place of origin).

NOTE The place of origin can be given by GPS coordinates.

The petrographic definition shall be determined in accordance with DRS 527.

4.2.3 Visual appearance

4.2.3.1 General

When required this characteristic shall be declared.

The colour, veining, texture, etc. of the stone shall be identified visually, typically by a reference sample of the same stone suitable for providing a general description of visual appearance. The reference sample shall be provided by the manufacturer.

4.2.3.2 Reference sample, visual inspection and acceptance criteria

A reference sample shall be an adequate number of specimens of natural stone of sufficient size to indicate the general appearance of the finished work. The dimensions of individual pieces shall be at least 0,01 m² (typical values are between 0,01 and 0,25 m² in face area but may be more), and shall indicate the range of appearance regarding the colouring, the vein pattern, the physical structure and the surface finish. In particular the reference sample shall show specific characteristics of the stone, such as typical holes, glass seams, spots, crystalline veins and rusty spots.

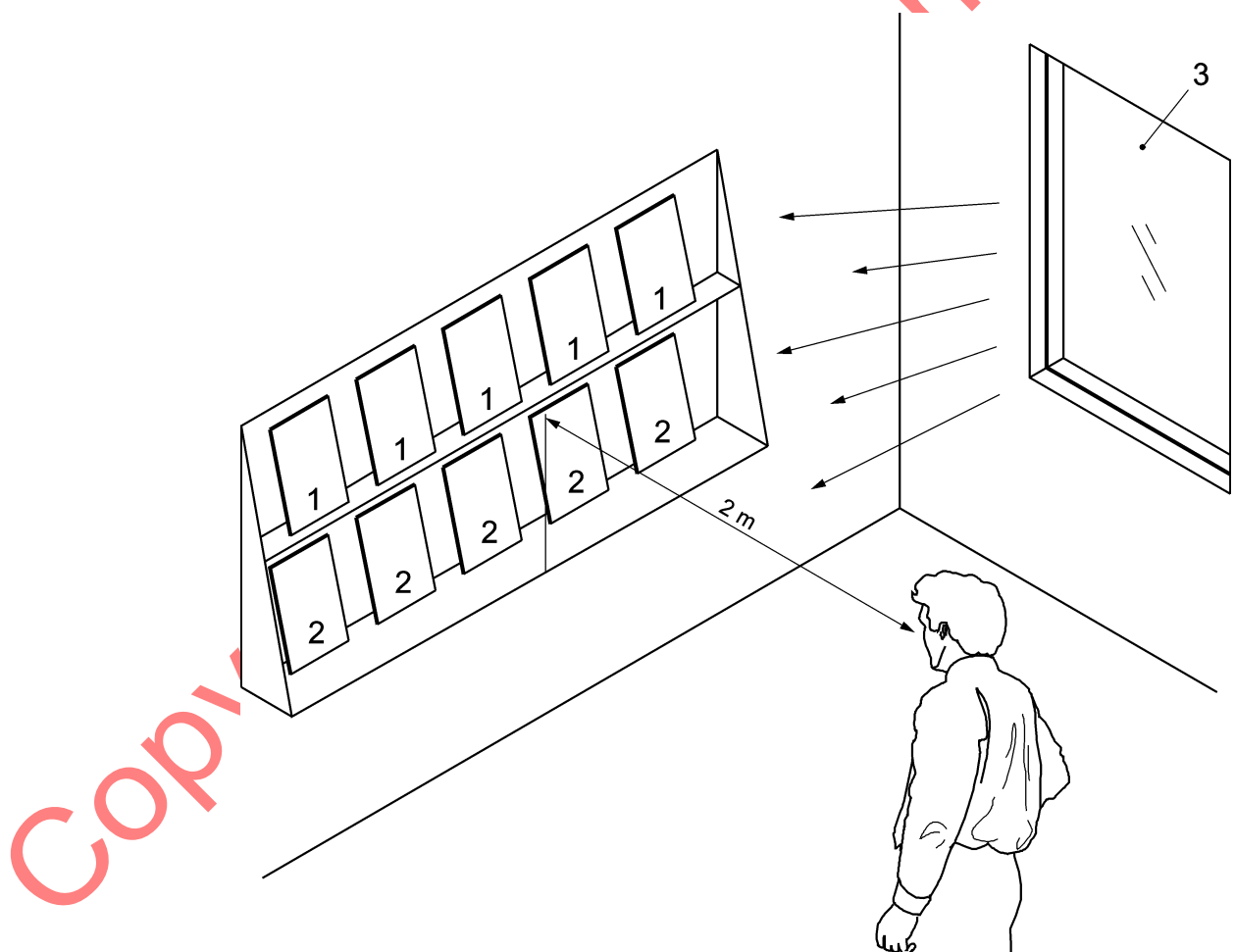
The reference sample does not imply strict uniformity between the sample itself and the actual supply; natural variations may always occur.

If the processing of the stone involves the use of patching, fillers or other similar products for natural holes, faults or cracks, then the reference sample shall similarly display the impact of the same on the finished surface.

All the characteristics as shown by the reference sample shall be considered typical of the stone and not as flaws, therefore they shall not become a reason for rejection, unless their concentration becomes excessive and the typical character of the stone is lost.

The name and address of the producer or the supplier, as well as the denomination of the stone in accordance with 4.2.2 above, shall be indicated on the reference sample.

Any comparison between production sample and reference sample shall be carried out by placing the reference sample against the production samples and viewing them at a distance of about two metres under normal daylight conditions and recording any visible differences in the characteristics of the stones (see Figure 3).



Key

1 reference sample

2 production sample

3 daylight

Figure 3 — Comparison between production sample and reference sample

All visible variations such as cracks, inclusions, cavities, stylolites and veins are permitted as far as they are typical for the stone and the performance of the stone is not adversely affected.

4.2.4 Flexural strength

When required this characteristic shall be declared.

The flexural strength shall be determined using the test method specified in DRS 533 and the mean value, lower expected value and standard deviation shall be declared.

Where the surface finish of the delivered product has an influence on the characteristic, the test shall be carried out with this finish, in accordance with the technological tests defined in DRS 533.

4.2.5 Resistance to fixings

The characteristic is carried out by determining the breaking load at a dowel hole. It shall be declared when the slabs are to be mechanically fixed using dowels on the edges.

The breaking load at a dowel hole shall be determined using the test method in DRS 529 and the mean value, lower expected value and standard deviation shall be declared.

Where the surface finish of the delivered product has an influence on the characteristic, the test shall be carried out with this finish, in accordance with the technological tests defined in DRS 529.

If a different mechanical fixing is to be used the suitability of the stone is determined from a structural analysis taking into account the location and the technical properties of the material.

Anchor holes shall not be drilled by percussion drilling machines.

4.2.6 Water absorption at atmospheric pressure

When required this characteristic shall be declared.

Where required the water absorption shall be determined using the test method in DRS 549 and the higher expected value (E_H) shall be declared.

4.2.7 Reaction to fire

When required this characteristic shall be declared.

Natural stones shall be considered reaction to fire Class A1.

— natural stones containing asphalt at greater than 1 % by mass or volume, whichever is the more onerous, and having a final use subject to fire regulations, shall be tested for reaction to fire and classified in accordance with DRS 547;

— whenever processing of natural stones involves the use of organic patching, fillers or other similar products for natural holes, faults, cracks or similar, at greater than 1 % by mass or volume, whichever is the more onerous and the same stones have a final use subject to fire regulations, then they shall be tested for reaction to fire and classified in accordance with DRS 547.

4.2.8 Water absorption by capillarity

When required this characteristic shall be declared (e.g.: when the cladding slab is to be used for elements in contact with a horizontal surface where water may be present).

The water absorption by capillarity shall be determined using the test method in DRS 525 and expressed as higher expected value (E_H).

For stone having an open porosity less than 1,0 % this test shall not be performed.

4.2.9 Apparent density and open porosity

When required this characteristic shall be declared.

The apparent density and open porosity shall be determined using the test method in DRS 526 and the mean values of the results expressed accordingly.

4.2.10 Durability

4.2.10.1 Resistance to thermal shock

When required this characteristic shall be declared.

The resistance to thermal cycles shall be determined using the test method in DRS 541 and the changes both in porosity and in flexural strength expressed accordingly.

4.2.10.2 Resistance to thermal and moisture cycling

The resistance of marble to thermal and moisture cycling shall be declared upon request only for marble intended for cladding of building facades and determined according to DRS 531.

For scientific definition of marble, see DRS 515.

4.2.11 Water vapour permeability

This characteristic shall be declared when the slab is to be used in a location subject to vapour control requirements.

The permeability coefficient shall be tested or given as tabulated values in accordance with ISO 12572 and/or ISO 10456.

4.2.12 Direct airborne sound insulation

Where required this characteristic shall be declared and determined using the test method in DRS 526 and declared as mean value.

4.2.13 Thermal conductivity

Where required this characteristic shall be declared and determined using the test method in DRS 548 and declared as mean value.

4.2.14 Release of dangerous substances

4.2.14.1 Emission of radioactivity

There is evidence that for finished product, no dangerous concentration of radioactivity exists. A verification and declaration are required on emission of radioactivity when construction products covered by this standard are placed on markets.

4.2.14.2 Other dangerous substances

Before construction products covered by this standard are placed on markets, they shall have verification and declaration of no release of dangerous substances, in addition to those dealt with in other clauses.

4.2.15 Bond strength/adhesion

This standard does not consider fixing by means of mortar and adhesives.

NOTE The value of the bond strength adhesion and the durability depend on several influences, e.g.: the type of adhesive/mortar, the surfaces being bonded and the climatic conditions.

5 Testing, assessment and sampling methods

5.1 Testing

References to the test methods are given in Clause 4.

5.2 Sampling

5.2.1 General

This sub-clause specifies methods for obtaining samples of natural stone from quarries, or plants or buildings. Sampling from buildings may be necessary if the delivered natural stone product is already applied in a building.

The aim of sampling is to obtain a bulk sample that is representative of the average properties of the batch and of its variability.

The methods described are based on manual procedures. The methods described are limited to building and civil engineering purposes.

It is important that samplers are accordingly trained in the application of the methods set out in this document. In case of dispute or if tests are to be done by more than one organization all interested parties shall have the

opportunity to observe the sampling and should agree upon the number of sampling increments to be taken.

5.2.2 Principles of sampling

Proper and careful sampling and sample transport is a prerequisite for an analysis that will give reliable results. An adequate number of samples shall be taken to obtain a good estimation of the natural heterogeneity of the batch.

The sampler shall be informed of the aim of the sampling.

5.2.3 Taking bulk samples

The number and sizes of samples depend on the test methods for which they are taken. The number and shape of specimens are given in the relevant test methods.

5.2.4 Preparing a sampling plan

A sampling plan shall be prepared, prior to sampling, taking into account the following:

- a) the type of the natural stone (following DRS 528 and DRS 515
- b) the aim of the sampling including a list of the properties to be tested;
- c) the identification of sampling points;
- d) the approximate size of samples;
- e) the number of samples;

- f) the sampling apparatus to be used;
- g) the methods of sampling;
- h) the marking, packaging and dispatch of the samples.

5.2.5 Sampling apparatus

Any suitable cutting equipment for natural stone may be used for sampling. In addition, drills, which are suitable for taking drill cores, may be used.

5.2.6 Sampling methods

5.2.6.1 General

The sampling methods will inevitably involve the samplers working at a quarry, plant or building. Regulations for safety and ergonomics shall be followed.

5.2.6.2 Sampling from quarries

5.2.6.2.1 General

The sample shall be taken by a qualified specialist, experienced in the examination of natural stone deposits. The main objective of sampling from such deposits is to establish, the average, the range of variations and the differences in the structure and properties of the natural stone, taking account of the fabric and geological structure and the anticipated quarrying conditions.

5.2.6.2.2 Sampling of solid rock

- a) Identification of anisotropy and orientation of samples

If the exploratory work reveals a pronounced fabric or geological structure which is not necessarily visible at the sample scale (e.g.: stratification, massive bedding, lamination, cleavage or rift), the sample shall be marked accordingly.

- b) Sampling for petrographic analysis

For petrographic analysis, hand specimens shall be taken from all distinct types and varieties which characterize the rock in terms of mineral composition, fabric and geological structure.

Samples from drilling (cores and pieces) may also be used.

In addition to samples of fresh material, samples shall also be taken to illustrate the effects of weathering.

- c) Sampling for physical testing

For physical testing, sample blocks shall be used as samples, their number and location depending on the results of the petrographic analysis and the required test methods.

The sample blocks shall measure approximately 0,40 m × 0,25 m × 0,25 m or more where a coarse-grained and/or a large-pored rock is to be sampled.

It is recommended that they are taken from larger natural stones which have been least affected by blastings. Care shall be applied to ensure the sample blocks do not show any hairline cracks resulting from the removal process.

Samples may also be cut from rough blocks, slabs or dimension stones, the number and size of samples depending on the particular test method.

5.2.6.2.3 Sampling from plants

A representative sample of adequate size and characteristic of the natural stone in terms of mineral composition, fabric and geological structure, shall be taken from the material to be tested (e.g. slabs, dimension stones), taking into account the intended use of the material.

5.2.6.2.4 Sampling at the point of delivery

Where sampling at the point of delivery (e.g. a construction site) of the products is required, with regard to ensuring the accuracy, reliability and stability, sample testing and assessment of each consignment shall be carried out.

The testing and control should consist of at least the following characteristics.

- a) Geometrical properties
- b) Visual appearance;
- c) Mechanical strength by direct or indirect test.

5.2.7 Marking, packaging and dispatch of the samples

The samples or containers shall be clearly and durably marked. Marking shall include:

- a) a unique code, or
- b) identification of the laboratory samples, place of sampling, date of sampling and denomination of the material.

The laboratory samples shall be packed and transported in such a way that they are protected from damage.

5.2.8 Sampling report

5.2.8.1 The sampler shall prepare a sampling report for each laboratory sample or for each group of laboratory samples from a single source. The sampling report shall refer to this Standard and state:

- a) the sampling report identification (serial number);
- b) the laboratory sample identification mark(s);
- c) the date and place of sampling;
- d) sampling point(s) or identification of the batch sampled;
- e) a reference to the sampling plan prepared according to 5.2.4;
- f) the name of the sampler(s).

5.2.8.2 Depending on the circumstances, other information might be relevant. Table 3 shows an example of a comprehensive sampling report

Table 3 — Example of a sampling report

Sampling report identification (serial n°):
Laboratory sample identification mark: no. of package

Description of the natural stone and sampling places

Name of the quarry or production plant or building:
Name of producer:
Origin of batch:
Purpose for which the natural stone is to be used:
Location of sampling point(s):
Identification of the batch:
Size of the batch:
Other comments (e.g. warnings, if appropriate):

Description of the sampling method

Date and time of sampling:
Reference to sampling plan used:
Sampling procedure (drilling, cutting, etc.)
Purpose of the sampling

Samples

No. and dimensions of samples:
Other comments:
Dispatch of the samples:
Sampler(s) (print name):

Contract details

Contract identification:
Name and address of party requesting the sampling:.....
Name of person(s) present at sampling:.....
Signatures:.....
.....

6 Assessment and verification of constancy of performance - AVCP

6.1 General

The compliance of natural stone slabs for cladding for walls and ceilings with the requirements of this standard and with the declared values shall be demonstrated by:

- a) determination of the product type on the basis of type testing
- b) documented factory production control by the manufacturer, including product assessment.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the conformity of the product with its declared performance(s).

6.2 Type Testing

6.2.1 General

All performances related to characteristics included in this standard shall be determined when the manufacturer intends to declare the respective performances unless the standard gives provisions for declaring them without performing tests. [e.g. use of previously existing data, CWFT (Classification without further testing) and conventionally accepted performance). A list of possible characteristics is given in Table 4.

Assessments previously performed in accordance with the provisions of this standard, may be taken into account provided that they were made to the same or a more rigorous test method, under the same AVCP

system on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question.

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for one or more characteristics from any one product within the family (description as given in marking, for e.g.: CE marking) are representative of those same characteristics for all products within that same family

NOTE Products may be grouped in different families for different characteristics.

Reference to the test method standards should be made to allow the selection of a suitable representative sample.

In addition, the determination of the product type shall be performed for all characteristics included in the standard for which the manufacturer declares the performance

- a) at the beginning of the production of a new or modified natural stone slabs for cladding (unless a member of the same family), or they shall be repeated for the appropriate characteristic(s), whenever a change occurs identified by the Factory Production Control in the natural stone slabs for cladding design, in the raw material or in the supplier of the components, or in the production process, which would affect significantly one or more of the characteristics;
- b) the beginning of a new or modified method of production (where this may affect the stated properties). Where components (i.e.: rough blocks, rough slabs) are used whose characteristics have already been determined, by the component manufacturer, on the basis of compliance with other product standards, these
- c) characteristics need not be re-assessed. The specifications of these components shall be documented, as shall be included in the inspection scheme for ensuring their compliance. Products bearing a regulatory marking in accordance with appropriate specifications may be presumed to have the performances stated with that marking, although this does not replace the responsibility on the natural stone slabs for cladding producer to ensure that the natural stone slabs for cladding as a whole is correctly designed and its component products have the declared performance values.

6.2.2 Test samples, testing and compliance criteria

The number of samples of the natural stone for cladding to be tested/assessed shall be in accordance with Table 4

Table 4 — Number of samples to be tested and compliance criteria

Characteristic	Requirement	Assessment method	No. of samples	Compliance criteria
Geometrical characteristics	4.1	5.2 and 4.1	See DRS 530	4.1
Petrographic description	4.2.2	5.2 and 4.2.2	See DRS 528	4.2.2
Visual appearance	4.2.3	5.2 and 4.2.3	See 4.2.3	4.2.3

Flexural strength	4.2.4	5.2 and 4.2.4	See DRS 533	4.2.4
Resistance to fixings	4.2.5	5.2 and 4.2.5	See DRS 529	4.2.5
Water absorption at atmospheric pressure	4.2.6	5.2 and 4.2.6	See DRS 549	4.2.6
Reaction to fire	4.2.7	5.2 and 4.2.7	See DRS 547	4.2.7
Water absorption by capillarity	4.2.8	5.2 and 4.2.8	See DRS 525	4.2.8
Apparent density and open porosity	4.2.9	5.2 and 4.2.9	See DRS 526	4.2.9
Resistance to thermal shock	4.2.10.2	5.2 and 4.2.10.2	See DRS 541	4.2.10.2
Resistance to thermal and moisture cycling	4.2.10.3	5.2 and 4.2.10.3	See DRS 531	4.2.10.3
Water vapour permeability	4.2.11	5.2 and 4.2.11	See ISO 12572 and/or ISO 10456	4.2.11
Direct airborne sound insulation	4.2.12	5.2 and 4.2.12	See DRS 526	4.2.12
Thermal conductivity	4.2.13	5.2 and 4.2.13	See DRS 548	4.2.13
Release of radioactivity	4.2.14.1	4.2.14.1 and 5.2	As relevant	4.2.14.1
Release of dangerous substances other than radioactivity	4.2.14.2	4.2.14.2 and 5.2	As relevant	4.2.14.2

6.2.3 Test reports

The results of the determination of the product type shall be documented in test reports. All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the natural stone slabs for cladding to which they relate.

6.2.4 Shared other party results

A manufacturer may use the results of the product type determination obtained by someone else (e.g. by another manufacturer, as a common service to manufacturers, or by a product developer), to justify his own declaration of performance regarding a product that is manufactured according to the same design (e.g. dimensions) and with raw materials, constituents and manufacturing methods of the same kind, provided that—
the results are known to be valid for products with the same essential characteristics relevant for the product performance;

- a) in addition to any information essential for confirming that the product has such same performances related to specific essential characteristics, the other party who has carried out the determination of the product type concerned or has had it carried out, has expressly accepted to transmit to the manufacturer the results and the test report to be used for the latter's product type determination, as well

as information regarding production facilities and the production control process that can be taken into account for FPC;

NOTE The formulation of such an agreement can be done by license, contract, or any other type of written consent.

- b) the manufacturer using other party results accepts to remain responsible for the product having the declared performances and he also:
- c) ensures that the product has the same characteristics relevant for performance as the one that has been subjected to the determination of the product type, and that there are no significant differences with regard to production facilities and the production control process compared to that used for the product that was subjected to the determination of the product type; and
- d) keeps available a copy of the determination of the product type report that also contains the information needed for verifying that the product is manufactured according to the same design and with raw materials, constituents and manufacturing methods of the same kind.

6.2.5 Cascading determination of the product type results

For some construction products, there are companies (often called “system houses”) which supply or ensure the supply of, on the basis of an agreement, some or all of the components (e.g.: in case of windows: profiles, gaskets, weather strips) to an assembler who then manufactures the finished product (referred to below as the “assembler”) in his factory.

NOTE This can be, for instance, a contract, license or whatever kind of written agreement, which should also contain clear provisions with regard to responsibility and liability of the component producer (system house, on the one hand, and the assembler of the finished product, on the other hand. These companies may produce components but they are not required to do so

Provided that the activities for which such a system house is legally established include manufacturing/assembling of products as the assembled one, the system house may take the responsibility for the determination of the product type regarding one or several essential characteristics of an end product which is subsequently manufactured and/or assembled by other firms in their own factory.

When doing so, the system house shall submit an “assembled product” using components manufactured by it or by others, to the determination of the product type and then make the determination of the product type report available to the assemblers, i.e. the actual manufacturer of the product placed on the market.

To take into account such a situation, the concept of cascading determination of the product type might be taken into consideration in the technical specification, provided that this concerns characteristics for which either a notified product certification body or a notified test laboratory intervene, as presented below.

The determination of the product type report that the system house has obtained with regard to tests carried out by a notified body, and which is supplied to the assemblers, may be used for the regulatory marking purposes without the assembler having to involve again a notified body to undertake the determination of the product type of the essential characteristic(s) that were already tested, provided that:

- a) the assembler manufactures a product which uses the same combination of components (components with the same characteristics), and in the same way, as that for which the system house has obtained the

determination of the product type report. If this report is based on a combination of components not representing the final product as to be placed on the market, and/or is not assembled in accordance with the system house's instruction for assembling the components, the assembler needs to submit his finished product to the determination of the product type;

- b) the system house has notified to the manufacturer the instructions for manufacturing/assembling the product and installation guidance;
- c) the assembler (manufacturer) assumes the responsibility for the correct assembly of the product in accordance with the instructions for manufacturing/assembling the product and installation guidance notified to him by the system house;
- d) the instructions for manufacturing/assembling the product and installation guidance notified to the assembler (manufacturer) by the system house are an integral part of the assembler's Factory Production Control system and are referred to in the determination of the product type report;
- e) the assembler is able to provide documented evidence that the combination of components he is using, and his way of manufacturing, correspond to the one for which the system house has obtained the determination of the product type report (he needs to keep a copy of the system house's determination of the product type report);
- f) regardless the possibility of referring, on the basis of the agreement signed with the system house, to the latter's responsibility and liability under private law, the assembler remains responsible for the product being in compliance with the declared performances, including both the design and the manufacture of the product, which is given when he affixes the regulatory marking on his product.

6.3 Factory production control (FPC)

6.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market comply with the declared performance of the essential characteristics.

The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product. All the elements, requirements and provisions adopted by the manufacturer shall be recorded in a systematic manner in the form of written policies and procedures.

This factory production control system documentation shall ensure a common understanding of the evaluation of the constancy of performance and enable the achievement of the required product performances and the effective operation of the production control system to be checked. Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with the declared performances of the essential characteristics.

In case the manufacturer has used shared or cascading product type results, the FPC shall also include the appropriate documentation as foreseen in 6.2.4 and 6.2.5.

6.3.2 Requirements

6.3.2.1 General

This production control system documentation shall ensure a common understanding of conformity evaluation and enable the achievement of the required product characteristics and the effective operation of the production control system to be checked. Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with this Standard.

The manufacturer is responsible for organizing the effective implementation of the FPC system in line with the content of this product standard. Tasks and responsibilities in the production control organization shall be documented and this documentation shall be kept up-to-date.

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting the constancy of performance of the product, shall be defined. This applies in particular to personnel that needs to initiate actions preventing product non-constancies from occurring, actions in case of non-constancies and to identify and register product conformity problems.

Personnel performing work affecting the constancy of performance of the product shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

In each factory the manufacturer may delegate the action to a person having the necessary authority to:

- a) identify procedures to demonstrate the constancy of performance of the product at appropriate stages;
- b) identify and record any instance of non-constancy;
- c) identify procedures to correct instances of non-constancy.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control. The manufacturer's documentation and procedures should be appropriate to the product and manufacturing process. The FPC system should achieve an appropriate level of confidence in the constancy of performance of the product. This involves:

- a) the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the technical specification to which reference is made;
- b) the effective implementation of these procedures and instructions;
- c) the recording of these operations and their results;
- d) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-constancy and, if necessary, revise the FPC to rectify the cause of non-constancy.

Where subcontracting takes place, the manufacturer shall retain the overall control of the product and ensure that he receives all the information that is necessary to fulfil his responsibilities according to this Standard.

If the manufacturer has part of the product designed, manufactured, assembled, packed, processed and/or labelled by subcontracting, the FPC of the subcontractor may be taken into account, where appropriate for the product in question.

The manufacturer who subcontracts all of his activities may in no circumstances pass these responsibilities on to a subcontractor.

6.3.2.2 Equipment

6.3.2.2.1 Testing

All weighing, measuring and testing equipment shall be calibrated or retraceable to measurement standards and regularly inspected according to documented procedures, frequencies and criteria.

6.3.2.2.2 Manufacturing

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer's written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

6.3.2.2.3 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their compliance. In case supplied kit components are used, the attestation of conformity level of the component shall be that given in the appropriate harmonized technical specification for that component.

6.3.2.2.4 Traceability and marking

Natural stone slabs for cladding shall be identifiable and traceable with regard to the original source. The manufacturer shall have recorded procedures ensuring that processes related to affixing traceability codes and/or markings are inspected regularly.

6.3.2.3 Controls during manufacturing process

The manufacturer shall plan and carry out production under controlled conditions.

During the manufacturing process the manufacturer shall apply a continuous verification of characteristics in accordance with manufacturer's FPC plan.

The control testing of each of these characteristics is to be carried out using the most appropriate direct or indirect test/check method(s), which is to be detailed in the manufacturer's quality control plan for the parameter(s).

6.3.2.4 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of the characteristics he declares are maintained. The characteristics and the means of control are given in Table 5

Table 5 — Characteristics and means of control for factory production control

Reference to clause for applicability ^a	Properties/ characteristics	Controls during manufacturing process	Minimum control frequency ^c	Test method in accordance with
4.2.2	Petrographic description	Continuous verification in accordance with manufacturer's factory production control ^d	10 years	DRS 527
4.2.3	Visual appearance		Every production lot	Visual
4.1	Geometrical characteristics		Every production lot	DRS 530
4.2.4	Flexural strength		2 years	DRS 533
4.2.5	Resistance to fixings ^b		10 years	DRS 529
4.2.6	Water absorption at atmospheric pressure		2 years	DRS 549
4.2.7	Reaction to fire ^b (only where testing is required)		10 years	DRS 547
4.2.8	Water absorption by capillarity ^b		10 years	DRS 525
4.2.9	Apparent density and open porosity		2 years	DRS 526
4.2.10.2	Resistance to thermal shock ^b		10 years	DRS 541
4.2.10.3	Resistance of marble to thermal and moisture cycling ^b		10 years	DRS 531
4.2.11	Water vapour permeability ^b		10 years	ISO 10456 and/or ISO 12572
4.2.12	Direct airborne sound insulation ^b		10 years	DRS 526
4.2.13	Thermal conductivity ^b		10 years	DRS 548
4.2.14.1	Release of radioactivity ^b		10 years	See
4.2.14.2	Release of other dangerous substances ^b	10 years	As relevant	

- a Reference shall be made to these clauses in order to decide which characteristics need to be declared. Only for products intended for uses subject to this requirement.
- b
- c The testing frequency should be established so that it represents a means to guarantee the constancy of the product's performance and a reliable declaration for both the users and the manufacturer.
- d When alternative tests to the reference tests are used for the test procedure, their correlation to the reference test shall be determined and available for inspections
- e DRS 542 is under preparation.

6.3.2.5 Non-complying products

The manufacturer shall have written procedures which specify how non-complying products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures.

Where the product fails to satisfy the acceptance criteria, the provisions for non-complying products shall apply, the necessary corrective action(s) shall immediately be taken and the products or batches not complying shall be isolated and properly identified.

Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be properly recorded. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test.

With regard to any control result not meeting the requirements of this Standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the records.

6.3.2.6 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence.

6.3.2.7 Handling, storage and packaging

The manufacturer shall have procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration.

6.3.3 Product specific requirements

The FPC system shall:

- a) address this Standard and

b) ensure that the products placed on the market comply with the declared performance characteristics.

The FPC system shall include a product specific FPC, which identifies procedures to demonstrate compliance of the product at appropriate stages, i.e.:

a) the controls and tests to be carried out prior to and/or during manufacture according to a frequency laid down in the FPC test plan,

and/or

b) the verifications and tests to be carried out on finished products according to a frequency laid down in the FPC test plan.

If the manufacturer uses only finished products, the operations under b) shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

If the manufacturer carries out parts of the production himself, the operations under b) may be reduced and partly replaced by operations under a). Generally, the more parts of the production that are carried out by the manufacturer, the more operations under b) may be replaced by operations under a)

In any case the operation shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

NOTE Depending on the specific case, it can be necessary to carry out the operations referred to under a) and b), only the operations under a) or only those under b).

The operations under a) refer to the intermediate states of the product as on manufacturing machines and their adjustment, and measuring equipment etc. These controls and tests and their frequency shall be chosen based on product type and composition, the manufacturing process and its complexity, the sensitivity of product features to variations in manufacturing parameters etc.

The manufacturer shall establish and maintain records that provide evidence that the production has been sampled and tested. These records shall show clearly whether the production has satisfied the defined acceptance criteria and shall be available for at least three years.

Where the product fails to satisfy the acceptance measures, the provisions for non-complying products shall apply, the necessary corrective action shall immediately be taken and the products or batches not complying shall be isolated and properly identified.

Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be properly recorded. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test.

With regard to any control result not meeting the requirements of this Standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the records.

Individual products or batches of products and the related manufacturing documentation shall be completely identifiable and retraceable.

6.3.4 One-off products, pre-production products (e.g. prototypes) and products produced in very low quantity

The natural stone slabs for cladding produced as a one-off, prototypes assessed before full production is established, and products produced in very low quantities up to 10 m² per year) shall be assessed as follows.

For type assessment, the provisions of 6.2.1, 3rd paragraph apply, together with the following additional provisions:

- a) in case of prototypes, the test samples shall be representative of the intended future production and shall be selected by the manufacturer;
- b) on request of the manufacturer, the results of the assessment of prototype samples may be included in a certificate or in test reports issued by the involved third party.

The FPC system of one-off products and products produced in very low quantities shall ensure that raw materials and/or components are sufficient for production of the product. The provisions on raw materials and/or components shall apply only where appropriate. The manufacturer shall maintain records allowing traceability of the product.

For prototypes, where the intention is to move to series production, the initial inspection of the factory and

FPC shall be carried out before the production is already running and/or before the FPC is already in practice. The following shall be assessed:

- the FPC-documentation; and
- the factory.

In the initial assessment of the factory and FPC it shall be verified:

- that all resources necessary for the achievement of the product characteristics included in this

Standard will be available, and

- that the FPC-procedures in accordance with the FPC-documentation will be implemented and followed in practice, and
- that procedures are in place to demonstrate that the factory production processes can produce a product complying with the requirements of this Standard and that the product will be the same as the samples used for the determination of the product type, for which compliance with this Standard has been verified.

Once series production is fully established, the provisions of 6.3 shall apply.

6.3.5 Procedure for modifications

If modifications are made to the product, production process or FPC system that could affect any of the product characteristics declared according to this standard, then all the characteristics for which the manufacturer declares performance, which may be affected by the modification, shall be subject to the determination of the product type, as described in 6.2.1 and 6.3.2.7.

Where relevant, a re-assessment of the factory and of the FPC system shall be performed for those aspects, which may be affected by the modification.

All assessments and their results shall be documented in a report.

7 Marking and packaging

As a minimum of identification, each consignment shall carry the following indications:

- a) the denomination of the natural stone in accordance with DRS 528;
- b) quantities and dimensions of the slabs for cladding. Additional information is advisable:
- c) the mass of the slabs for cladding;
- d) dimensions and mass of packaging.

These indications shall be given on labels, packaging or on accompanying documents.

An identification system may be used in order to identify individual slabs; in such a case individual stones shall be clearly marked accordingly. Marking will usually consist of alphanumeric codes and symbols (e.g. to define proper orientation at installation).

The slabs for cladding shall be clean before packaging.

Packaging shall allow adequate, solid and durable protection for packed stones, both during transport and during handling and storage. Movement of slabs inside the packaging has to be prevented by securing individual pieces.

Packaging shall be of appropriate mass and size in consideration of transportation and lifting facilities; the top and bottom of the packaging as well as stacking possibility shall be indicated.

The supplier shall ensure safety against contamination caused by packaging materials, in wet or dry conditions.

Packaging and tapes which are likely to stain shall not be used. Sensitive polished surfaces shall be protected by appropriate means (for example plastic foil). Products with caustic properties shall not be used.

Where regulatory marking provisions require information on some or all items listed in this clause, the provisions of this clause concerning those common items are deemed to be met and the information needs not be repeated for the purpose of this clause

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